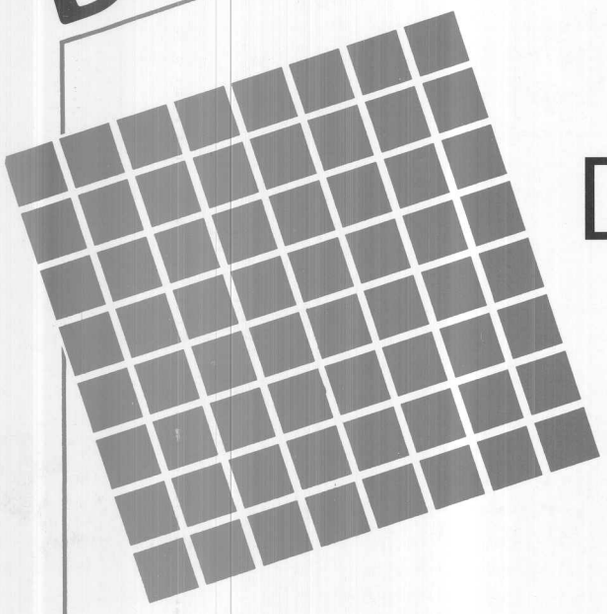
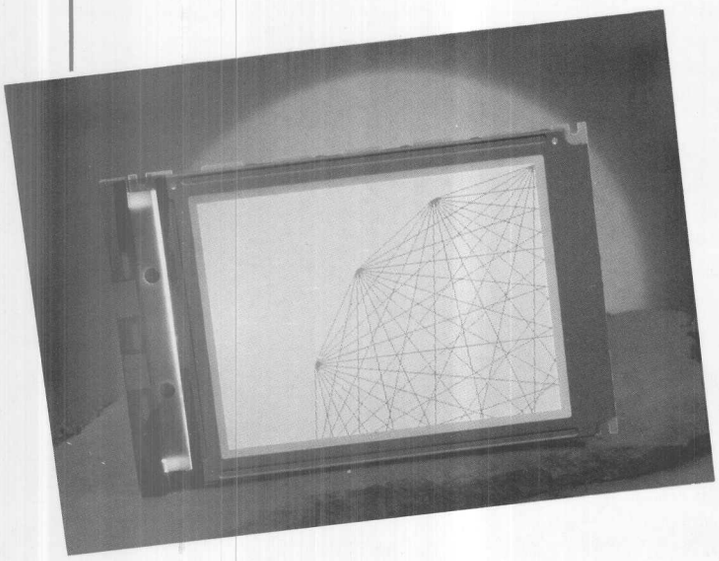
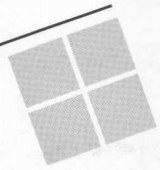
DENSITRON



DENSITRON SMALL GRAPHICS DISPLAYS



GRAPHIC LCDS



DENSITRON

DOT FORMAT	MODEL NO	OVERALL SIZE(mm)	VIEW AREA (mm)	DOT PITCH (mm)	DUTY
32 X 80	LM3400	84 x 44 x 11.3	46 x 18	.53 x .53	1/32
32 x 80	LM4400	84 x 44 x 14.6	46 x 18	.53 x .53	1/32
64 x 128	LM3328	87 x 71 x 11	62.5 x 43.5	.44 x .60	1/64
64 x 128	LM4328	87 x 71 x 15.6	62.5 x 43.5	.44 x .60	1/64
64 x 240	LM54	180 x 75 x 15	132 x 39	.53 x .53	1/32
64 x 240	LM83	180 x 75 x 12	132 x 39	.53 x .53	1/64
64 x 240	LMG264	180 x 75 x 12	132 x 39	.53 x .53	1/64
64 x 240	LM3083	180 x 75 x 10.1	132 x 39	.53 x .53	1/64
64 x 240	LM3183	180 x 75 x 10.1	132 x 39	.53 x .53	1/64
64 x 240	LM3267	180 x 65 x 10.1	132 x 39	.53 x .53	1/64
64 x 240	LM3283	180 x 75 x 10.1	132 x 39	.53 x .53	1/64
64 x 240	LM3287	154 x 57 x 11.3	112 x 31.5	.45 x .45	1/64
64 x 240	LM4083	180 x 75 x 15	132 x 39	.53 x .53	1/64
64 x 240	LM4183	180 x 75 x 15	132 x 39	.53 x .53	1/64
64 x 240	LM4267	180 x 65 x 10.1	132 x 39	.53 x .53	1/64
64 x 240	LM4283	180 x 75 x 15	132 x 39	.53 x .53	1/64
64 x 240	LM4287	154 x 57 x 16.3	112 x 31.5	.45 x .45	1/64
64 x 240	LM6183	180 x 75 x 15	132 x 39	.53 x .53	1/64
64 x 240	LM6283	180 x 75 x 15	132 x 39	.53 x .53	1/64
64 x 480	LM95	290 x 73 x 12	246 x 38	.50 x .50	1/64
128 x 128	LM3060	88 x 88 x 20.3	69 x 69	.50 x .50	1/128
128 x 128	LM3160	88 x 88 x 20.3	69 x 69	.50 x .50	1/128
128 x 240	LMG6627	128 x 77 x 23.5	78 x 44.5	.30 x .30	1/128
128 x 240	LM3129	144 x 104 x 10.8	114 x 64	.45 x .45	1/128
128 x 240	LM3229	144 x 104 x 10.8	114 x 64	.45 x .45	1/128
128 x 240	LM4129	144 x 104 x 15.6	114 x 64	.45 x .45	1/128
128 x 240	LM4229	144 x 104 x 15.6	114 x 64	.45 x .45	1/128
128 x 240	LM6129	144 x 104 x 15.6	114 x 64	.45 x .45	1/128
128 x 240	LM6229	144 x 104 x 15.6	114 x 64	.45 x .45	1/128
128 x 240	LM3024	194 x 96 x 9.5	135 x 76	.53 x .53	1/128
128 x 240	LM6024	194 x 96 x 16	135 x 76	.53 x .53	1/128
128 x 256	LM656	211 x 110 x 15	128 x 66.5	.48 x .48	1/64
128 x 480	LMG6685	270 x 100 x 14.5	224 x 65.6	.45 x .45	1/128
200 x 320	LMG50	157 x 110 x 13	125 x 79	.36 x .36	1/200
200 x 320	LM650	168 x 110 x 16	125 x 79	.36 x .36	1/200
200 x 320	LMG6683	166 x 95 x 11.5	120 x 77	.36 x .36	1/200
240 x 320	LMG620	167 x 110 x 11	121 x 92	.36 x .36	1/240
240 x 320 x RGB	LMG8382	180 x 130 x 10	121.5 x 92.5	.36 x .36	1/240

* Optional on-board negative voltage generator.

GRAPHIC CONTROLLER OPTIONS

Densitron Controller Options .....

Backlight Inverters .....

Description of Polariser Type .....

Ordering Information .....

SELECTION CHART

LCD DRIVE VOLTAGE(S)	ON-BOARD CONTROLLER	BACKLIGHT TYPE	INVERTER	POLARISER OPTION	PAGE NO
+5V	T9841B	EL	DAS5V4	A,B	5
+5V	T9841B	LED		B	5
+5V/-5V*	HD61202	EL	DAS5V7	A,B	5
+5V/-5V*	HD61202	LED		B	5
+5V/-5V	(EXTERNAL)	EL	DAS5V10	A,B	6
+5V/-12V	(EXTERNAL)	EL	DAS5V10	A,B	6
+5V	T6963C	EL	DAS5V10	A,B	7
+5V/-15V*	(EXTERNAL)	EL	DAS5V14	A,B	7
+5V/-15V*	HD61830	EL	DAS5V14	A,B	8
+5V/-15V*	T6963C	EL	DAS5V14	A,B	9
+5V/-15V*	T6963C	EL	DAS5V14	A,B	8
+5V/-12V	T6963C	EL	DAS5V14	A,B	9
+5V-15V*	(EXTERNAL)	LED		B	7
+5V/-15V*	HD61830	LED		B	8
+5V/-15V*	T6963C	LED		B	9
+5V/-15V*	T6963C	LED		B	8
+5V/-12V	T6963C	LED		B	9
+5V/-15V*	HD61830	CFL	INV12	B,E	10
5+V/-15V*	T6963C	CFL	INV12	B,E	10
+5V/-12V	(EXTERNAL)	EL	DAS5V13	A,B	11
+5V	(EXTERNAL)	EL	DAS5V10	A,B	11
+5V	HD61830B	EL	DAS5V10	A,B	12
+5V/-23V	(EXTERNAL)	CFLx2	DAS12F15-27	E	15
+5V/-20V*	HD61830B	EL	DAS5V14	A,B	12
+5V/-20V*	T6963C	EL	DAS5V14	A,B	13
+5V/-20V*	HD61830B			B,E	12
+5V/-20V*	T6963C	LED		B,E	13
+5V/-20V*	HD61830B	CFLx1	INV12	B,E	13
+5V/-20V*	T6963C	CFLx1	INV12	B,E	14
+5V/-20V	(EXTERNAL)	EL	DAS5V12	A,B	14
+5V/-20V	(EXTERNAL)	CFLx1	DAS5F10A	B,E	14
+5V/-12V	(EXTERNAL)	CFLx1	DAS24F06-22	E	15
+5V/-23V	(EXTERNAL)	CFLx1	DAS12F39-1	E	16
+5V/-23V	(EXTERNAL)	EL	DAS5V12	A,B	16
+5V/-23V	(EXTERNAL)	CFLx1	DAS24F06-39	B,E	17
+5V/-23V	(EXTERNAL)	CFLx1	DAS12F56	E	17
+5V/-23V	(EXTERNAL)	CFLx1	DAS12F39-1	E	18
+5V/-23V	(EXTERNAL)	CFLx2	DAS12F57	E	18

19

21

23

23

SELECTING A SMALL GRAPHICS MODULE

There are many factors which must be considered when selecting a small graphics LCD module for use in a particular application. An understanding of these factors and how they relate to module usage will facilitate the design engineer in selecting the most appropriate Densitron product for his requirement.

SIZE AND FORMAT

The design engineer should first define the type and quantity of information to be displayed on the small graphics LCD module. This will provide a range of possible dot formats which may be considered. For the display of text information, the maximum number of characters can be calculated by assuming a 6-dot wide by 8-dot high character font.

Displays containing rectangular dots are most suitable for text information, while graphical information is best presented using square dots. When the suitable display resolutions and dot formats are combined with the mechanical requirements and/or limitations of the application, one or more candidate graphics modules can be considered.

LCD VIEWING MODE AND BACKLIGHTING

The intended ambient viewing conditions of the display and available backlighting power will determine the most suitable combination of LCD viewing mode and backlighting method.

Reflective LCD's (A mode polariser) do not require backlighting and are best suited for viewing in high ambient light conditions, indoor or outdoor.
Transmissive LCD'S, (E or F mode polariser) which require a backlight for operation, are suitable for viewing conditions ranging from well-lit indoor conditions to dark environments, but are not intended for use in direct sunlight..
Transflective LCDs (B mode polariser) can be read in all lighting conditions, ranging from direct sunlight to total darkness with a backlight.

Backlight options include electroluminescent (EL) lamps, light emitting diode (LED) arrays and cold-cathode fluorescent (CFL) tubes.

EL backlights offer slim packaging, uniform brightness and low power. They operate from an AC power source, typically 400Hz @ 70-100VAC. The drawbacks of EL backlights are a limited lifetime, moderate brightness and the bulkiness and cost of the DC-AC inverter.

LED backlights offer high brightness, long lifetime and relatively low cost since they operate from a 5VDC supply.
Disadvantages include high power consumption and added module thickness.

CFL backlights feature uniform brightness, long lifetime and low power consumption. Typical drive frequency is 50KHz @ 1000VAC. Disadvantage are added module thickness and relatively high cost of the CFL backlight and inverter.

GRAPHICS CONTROLLERS

The small graphics modules in this catalog include models with on-board graphics controllers and others which are supported by Densitron controller cards (see page 19 of this catalog). In addition, the SGI-01 card allows serial interface to all Densitron small graphics modules up to 128x256 resolution.

On-board controllers include T6963C, HD61830, HD61202 and T9841B, all of which support 8-bit parallel microprocessor interface. Both the T6963C and HD61830 controllers contain internal character generator ROM and support a wide range of instruction functions. The HD61202 and T9841B controllers accept bit-mapped data only and have a more limited range of instruction function.

TEMPERATURE RANGE AND OPERATING VOLTAGE

Some of the modules listed in this catalog have been designed for outdoor use with an extended operating temperature range of -20C to +70C. In addition, some modules feature an optional on-board temperature compensation circuit which automatically adjusts the LCD drive voltage for optimum contrast over the operating temperature range.

In addition to the +5 V logic supply, graphics LCD modules require a negative bias voltage (from -5V to -23V depending on the duty cycle) to supply the appropriate voltage levels to the LCD driver ICs. Some modules feature an on-board negative voltage generator as standard or optional, while on others the user must supply this voltage.

LC FLUIDS AND DISPLAY CONTRAST

All Densitron small graphics modules use high contrast, supertwisted nematic LCD panels. The combination of different LCD fluids, polarizers and retardation films is used to produce the following display types and optical modes:

NTN - with yellow or grey background (positive contrast)
- with dark blue background (negative contrast)

STN - with yellow background (positive contrast)
- with dark blue background (positive contrast)

FSTN - with white background (positive contrast)
- with black background (negative contrast)

Availability of these different optical modes is dependent on the particular small graphics module. Because of their use of retardation films, FSTN modules have somewhat better contrast than STN and NTN displays.

Display contrast is also a function of the duty cycle at which the module is designed to operate. Therefore, a module which operates at a higher duty (such as 1/64) would exhibit better contrast and viewing angle characteristics than an equivalent module which operates at a lower duty (such as 1/200).

LM3400/4400

32 x 80 FORMAT

■ FITS STANDARD 2 x 16 WINDOW
■ EL AND LED BACKLIGHT OPTIONS ■ T9841B CONTROLLER

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
Current Consumption	I_{DD}			10.0	10.0	mA
						mA
LCD Drive Voltage (1/32 duty cycle)	V_{DD}-V_0	Temp 0°C		5.0		V
		Temp 25°C		5.0		V
		Temp 50°C		5.0		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

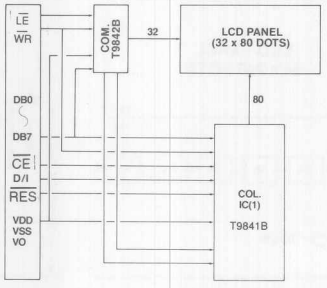
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	N/C	No Connection
4	D/I	Register Select I = Data Register 0 = Instruction Register
5	$\overline{WR}$	Write Select I = Read From T9841B 0 = Write To T9841B
6	$\overline{CE}$	Chip Enable for Command Codes

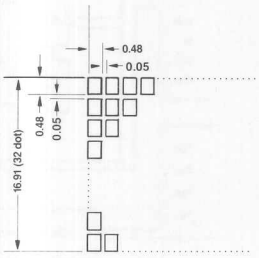
Pin No.	Symbol	Function
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{LE}$	Latch Enable
16	$\overline{RES}$	Reset

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	STANDARD	NO

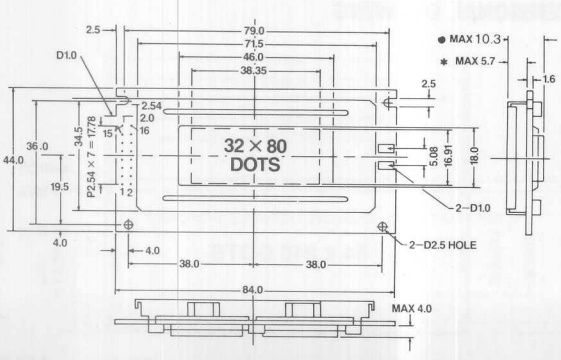
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LED BACKLIT LM4400 SERIES
● = 14.6 mm ✱ = 9.0 mm

LM3328/4328

64 x 128 FORMAT

■ HD61202 CONTROLLER
■ COMPACT MODULE DESIGN ■ EL OR LED BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-11.0	-12.0	-15.0	V
Current Consumption	I_{DD}			10		mA
	I_{EE}			5		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		16.2		V
		Temp 25°C		14.6		V
		Temp 50°C		13.5		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$		7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		20.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

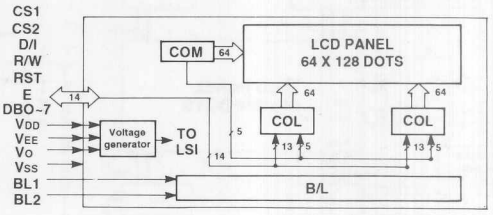
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adj
4	RS	Register Select 0 = Contrtol Data 1 = Display Data
5	R/$\overline{W}$	Read/Write: 0 = Write MPU - > LCD Module 1 = Read MPU < - LCD Module
6	E	Enable Signal: Active High (H ->L)
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

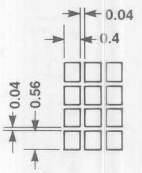
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS1}$	Chip Select
16	$\overline{RST}$	Reset
17	V_{EE}	Power Supply for LC driving
18	$\overline{CS2}$	Chip Select
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	NO

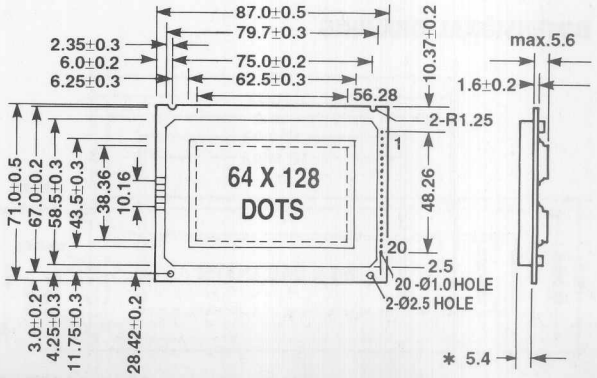
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LED BACKLIT LM4328 SERIES
✱ = 10.0 mm

64 x 240 FORMAT

LM54

■ 1/32 DUTY ■ HIGH CONTRAST
■ EL BACKLIGHT OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-4.75	-5.0	-5.25	V
Current Consumption	I_{DD}	fCL2 = 460KHz		3.5		mA
	I_{EE}	D_1,D_2 = GND		2.2		mA
LCD Drive Voltage (1/32 duty cycle)	V_{DD}-V_0	Temp 0°C		9.0		V
		Temp 25°C		8.3		V
		Temp40°C		7.6		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	0	16.0	V
Temperature ~ Operating	Top	0	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

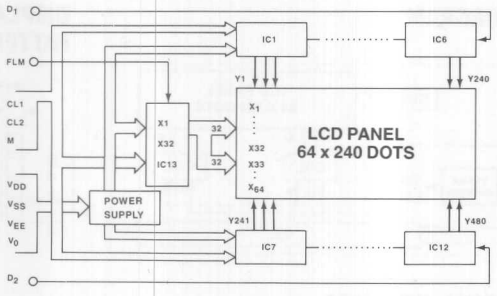
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D_1	Display data H..Dot on, L..Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

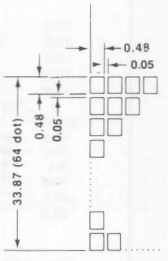
Pin No.	Symbol	Function
6	D_2	Display data H..Dot on, L..Dot off
7	V_{DD}	Power supply for logic circuit
8	V_{SS}	Ground
9	V_{EE}	Power supply for LC drivers
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

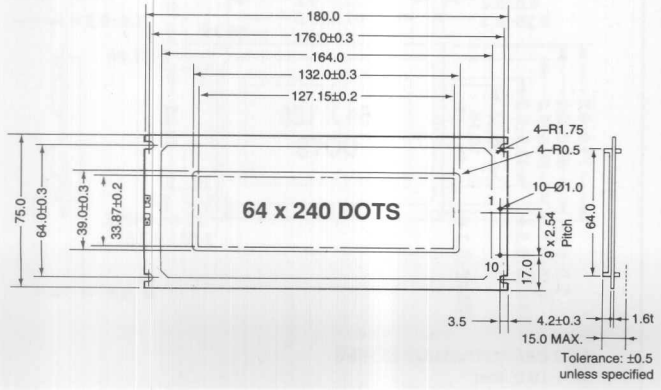
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



64 x 240 FORMAT

LM83

■ EL BACKLIGHT OPTION
■ 1/64 DUTY ■ INDUSTRY STANDARD

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-9.5	-10.0	-10.5	V
Current Consumption	I_{DD}	fCL2 = 1.11 MHz		4.0		mA
	I_{EE}	D = GND		1.0		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		12.5		V
		Temp 25°C		11.5		V
		Temp 40°C		10.7		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	0	16.0	V
Temperature ~ Operating	Top	0	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

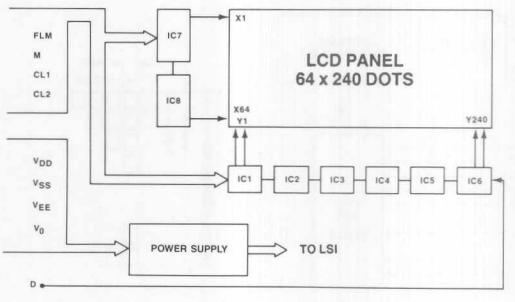
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D	Display data H..Dot on, L..Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

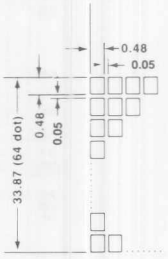
Pin No.	Symbol	Function
6	NC	
7	V_{DD}	Power supply for logic circuit
8	V_{SS}	Ground
9	V_{EE}	Power supply for LC drivers
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

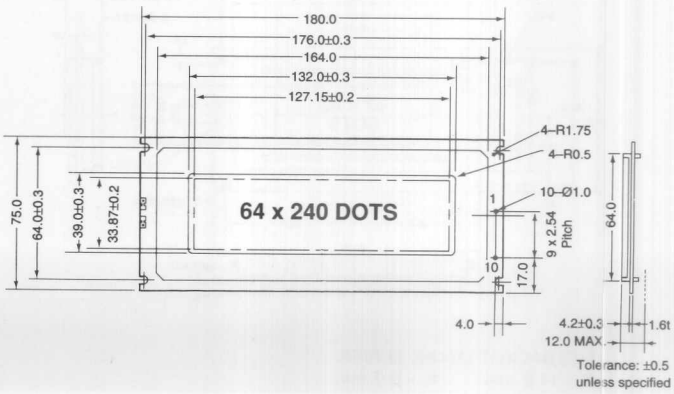
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG 264

64 x 240 FORMAT

■ T6963C CONTROLLER ON BOARD
■ SINGLE +5V POWER SUPPLY ■ EL BACKLIGHT OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage*	V_{DD}		4.75	5.0	5.25	V
Current Consumption	I_{DD}			20.0	36	mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		12.5		V
		Temp 25°C		11.5		V
		Temp 40°C		10.7		V

*Internally Generated

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
Temperature ~ Operating	Top	0	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

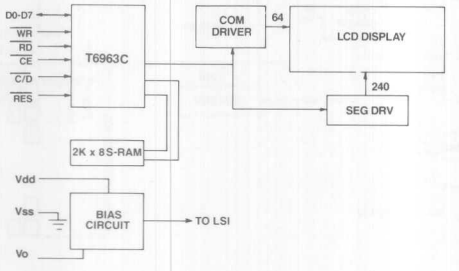
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D "H": Command Write C/D = "L": Data Write RD = "L"..C/D = "H": Status Read C/D = "L": Data Read
5	$\overline{WR}$	Write Data
6	$\overline{RD}$	Read Data
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

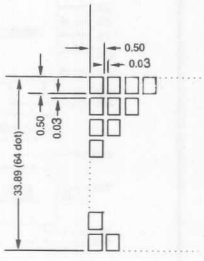
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	NC	No connection
18	V_{EE}	Internally generated
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	STANDARD	NO

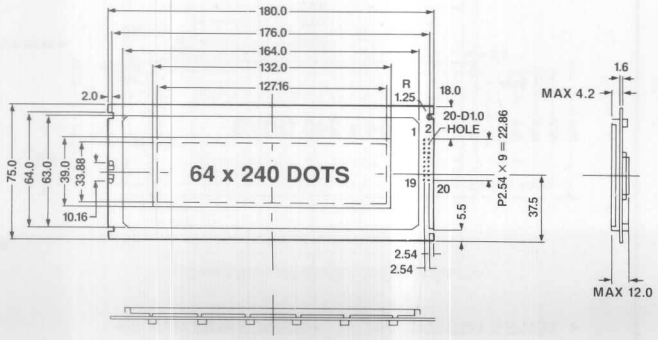
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3083/4083

64 x 240 FORMAT

■ INDUSTRY STANDARD FORMAT ■ EL OR LED BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		0	-14	-20	V
Current Consumption	I_{DD}			10		mA
	I_{EE}			5		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	25	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

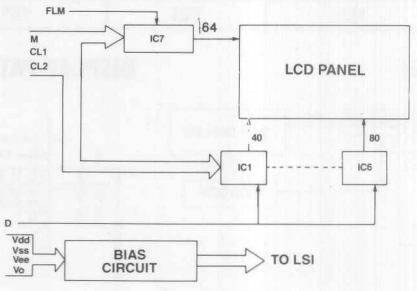
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D	Display data H = Dot on L = Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

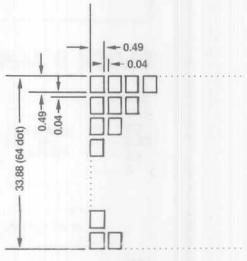
Pin No.	Symbol	Function
6	NC	No Connection
7	V_{DD}	Power supply for logic circuit (+5V)
8	V_{SS}	Ground
9	V_{EE}	Power supply for LC driving
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	NO	NO

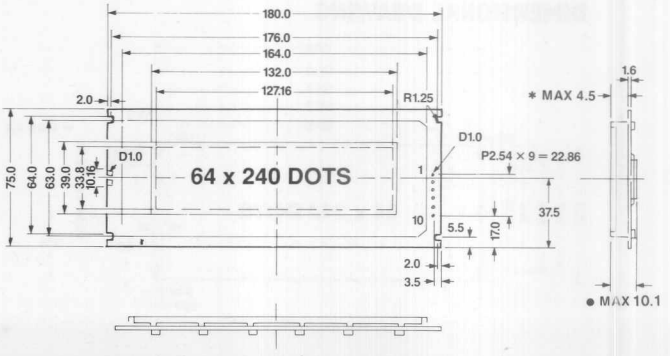
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LED BACKLIT LM4083 SERIES
● = MAX15 mm ✱ = MAX 9.4 mm

LM3183/4183

64 x 240 FORMAT

■ HD61830 CONTROLLER

■ EL OR LED BACKLIGHT ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}				-20	V
Current Consumption	I_{DD}			-14	25	mA
	I_{EE}				5	mA
LCD Drive Voltage (1/64duty cycle)	V_{DD}-V_O	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} - V_{SS}		7.0	V
LCD Drive Voltage	V_{DD} - V_{EE}		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

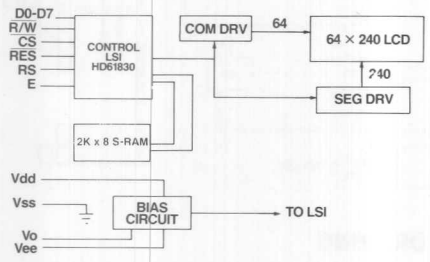
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage (+5V)
3	V_O	LC drive voltage for contrast adjustment
4	RS	Register Select: Instruction Reg I = Data Register
5	R/W	Read/Write: 0 = Write MPU - > LCD Module 1 = Read MPU <- LCD Module
6	E	Enable: Active High (H - > L)
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

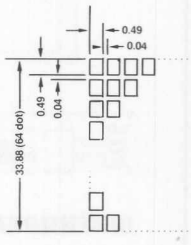
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS}$	Chip Select
16	$\overline{RES}$	Reset
17	V_{EE}	LCD Drive Voltage
18	NC	No connection
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

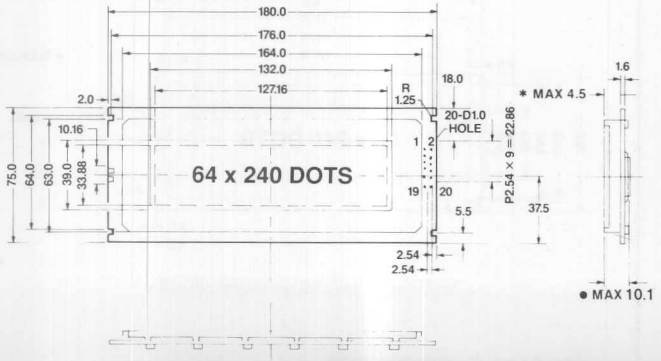
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



• SERIES 4183 MAX 15 * SERIES 4183 MAX 9.4

LM3283/4283

64 x 240 FORMAT

■ T6963 CONTROLLER

■ EL OR LED BACKLIGHT ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-14.0	-15.0	-16.0	V
Current Consumption	I_{DD}				25	mA
	I_{EE}				25	mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_O	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} ~ V_{SS}		7.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

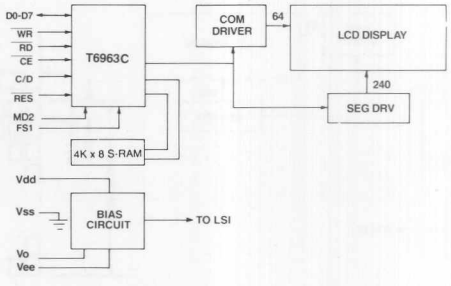
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_O	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D "H": Command Write C/D = "L": Data Write RD = "L"..C/D = "H": Status Read C/D = "L": Data Read
5	$\overline{RD}$	Data Read
6	$\overline{WR}$	Data Write
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

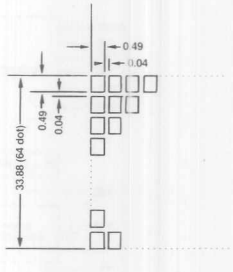
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	V_{EE}	LCD Drive Voltage
18	MD 2	Mode Selection
19	FS1	Font Size Selection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

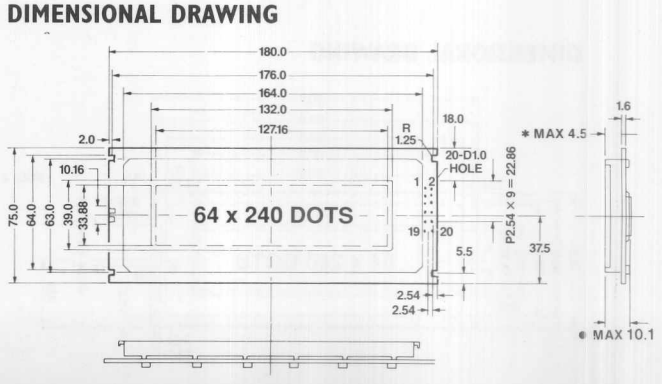
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



• SERIES 4283 MAX 15 * SERIES 4283 MAX 9.4

LM3287/4287

64 x 240 FORMAT

■ MINI 64 x 240

■ T6963 CONTROLLER ■ EL OR LED BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-11	-20	V
Current Consumption	I_{DD}			20		mA
	I_{EE}			4		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		15.7		V
		Temp 25°C		13.6		V
		Temp 50°C		11.5		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25.0	V
Temperature ~ Operating	Top	0	+50	°C
Temperature ~ Storage	Tstg	-20	+70	°C

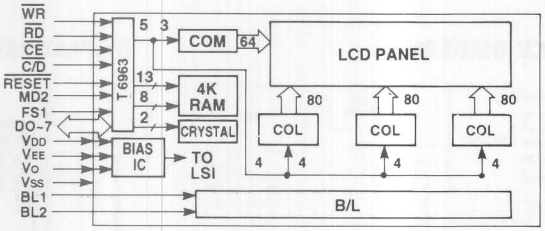
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D "H": Command Write C/D = "L": Data Write RD = "L"..C/D = "H": Status Read C/D = "L": Data Read
5	$\overline{RD}$	Data Read
6	$\overline{WR}$	Data Write
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

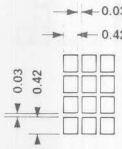
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	V_{EE}	Logic Supply Voltage
18	MD2	Mode Selection
19	FS1	Font Size Selection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	YES	NO

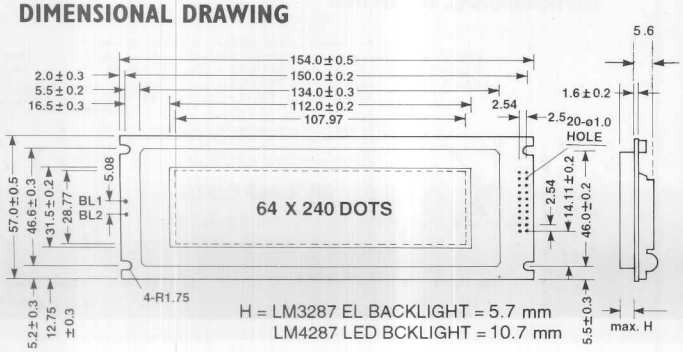
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3267/4267

64 x 240 FORMAT

■ REDUCED HEIGHT FORMAT

■ T6963C CONTROLLER ON BOARD ■ EL OR LED BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-14	-20	V
Current Consumption	I_{DD}			25		mA
	I_{EE}			5		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.6		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

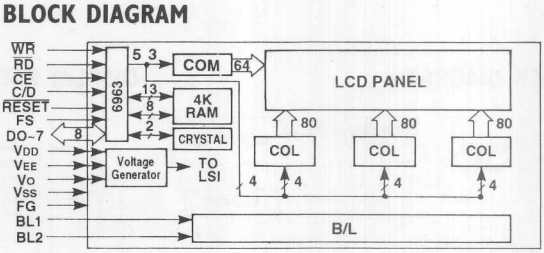
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FG	Frame Ground
2	V_{SS}	Ground
3	V_{DD}	Logic Supply Voltage
4	V_0	LCD drive voltage for contrast adjustment
5	$\overline{WR}$	Data Write
6	$\overline{RD}$	Data Read
7	$\overline{CE}$	Chip Enable
8	C/$\overline{D}$	WR = "L"..C/D "H": Command Write C/D = "L": Data Write RD = "L"..C/D = "H": Status Read C/D = "L": Data Read

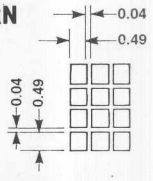
Pin No.	Symbol	Function
9	V_{EE}	Logic Supply Voltage
10	$\overline{RES}$	Reset
11	D0	Screen Data H = On L = Off
12	D1	Screen Data H = On L = Off
13	D2	Screen Data H = On L = Off
14	D3	Screen Data H = On L = Off
15	D4	Screen Data H = On L = Off
16	D5	Screen Data H = On L = Off
17	D6	Screen Data H = On L = Off
18	D7	Screen Data H = On L = Off
19	FS	Font Size Selection
20	N/A	

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	NO

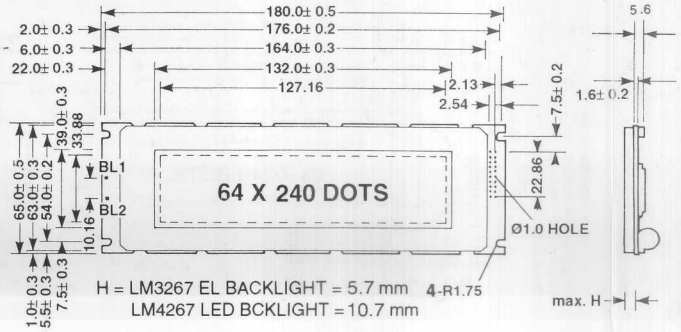
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



64 x 240 FORMAT

LM6183

■ CFL BACKLIGHT
■ HD61830 CONTROLLER ON-BOARD ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}				-20	V
Current Consumption	I_{DD}			-14	25	mA
	I_{EE}				5	mA
LCD Drive Voltage (1/64duty cycle)	V_{DD}-V_0	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} - V_{SS}		7.0	V
LCD Drive Voltage	V_{DD} - V_{EE}		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

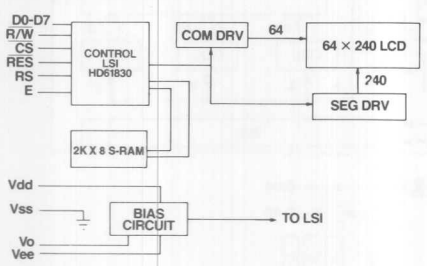
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage (+5V)
3	V_0	LC drive voltage for contrast adjustment
4	RS	Register Select: Instruction Reg I = Data Register
5	R/W	Read/Write: 0 = Write MPU - > LCD Module 1 = Read MPU <- LCD Module
6	E	Enable: Active High (H - > L)
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

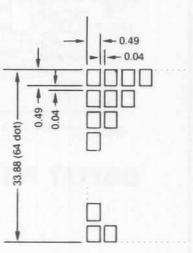
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS}$	Chip Select
16	$\overline{RES}$	Reset
17	V_{EE}	LCD Drive Voltage
18	NC	No connection
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

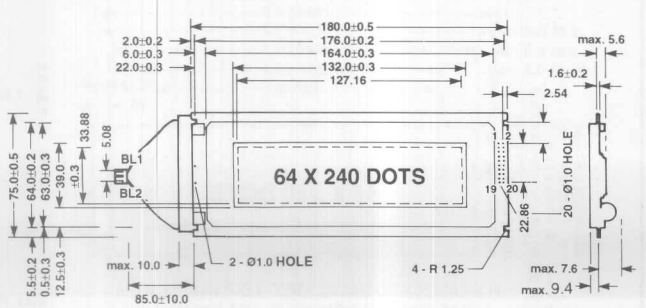
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



64 x 240 FORMAT

LM6283

■ CFL BACKLIGHT
■ T6963C CONTROLLER ON-BOARD ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-14.0	-15.0	-16.0	V
Current Consumption	I_{DD}				25	mA
	I_{EE}				25	mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		18.8		V
		Temp 25°C		16.1		V
		Temp 50°C		13.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} ~ V_{SS}		7.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

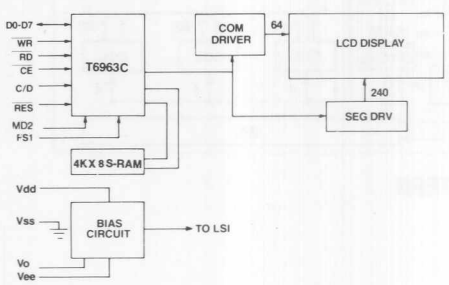
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D "H": Command Write C/D = "L": Data Write RD = "L"..C/D = "H": Status Read C/D = "L": Data Read
5	$\overline{RD}$	Data Read
6	$\overline{WR}$	Data Write
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

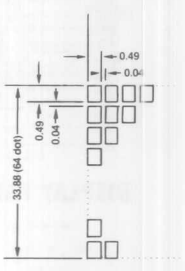
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	V_{EE}	LCD Drive Voltage
18	MD 2	Mode Selection
19	FS1	Font Size Selection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

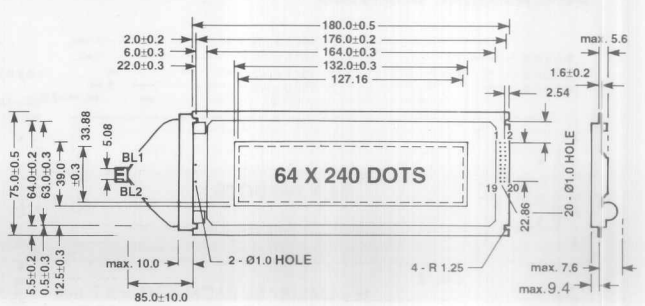
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM95

64 x 480 FORMAT

■ 8 LINE BY 80 CHARACTER FORMAT ■ EL BACKLIGHT OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-12.0		V
Current Consumption	I_{DD}	fCL2 = 2.15MHz		6.0		mA
	I_{EE}	D = GND		2.5		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		14.2		V
		Temp 25°C		12.8		V
		Temp 40°C		11.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	18.0	V
Temperature ~ Operating	Top	0	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

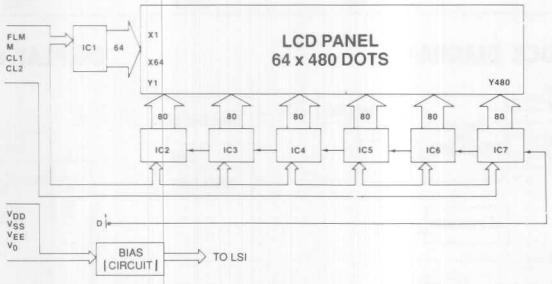
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D	Display data H..Dot on, L..Dot off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

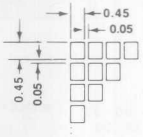
Pin No.	Symbol	Function
6	NC	No Connection
7	V_{DD}	Power supply for logic circuit (+5V)
8	V_{SS}	Ground
9	V_{EE}	Power supply for LC driving
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

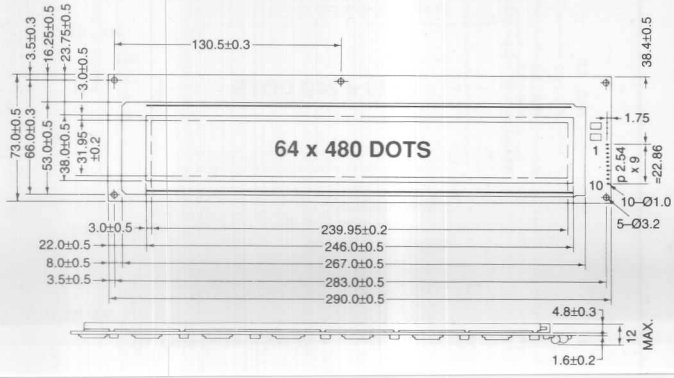
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3060

128 x 128 FORMAT

■ COMPACT SQUARE PACKAGE ■ SINGLE +5V POWER SUPPLY

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage*	V_{EE}			-17.0	-20.0	V
Current Consumption	I_{DD}			30		mA
						mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 0°C		21.1		V
		Temp 25°C		19.4		V
		Temp 50°C		17.3		V

*Internally Generated

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

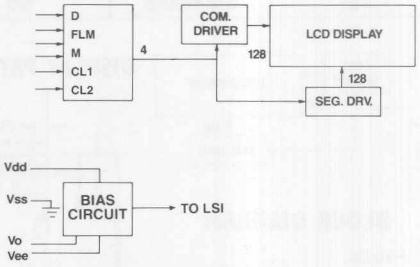
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D	Display data H..Dot On, L..Dot Off
2	FLM	First line marker indicates the beginning of each display cycle
3	M	Control signal for AC drive
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

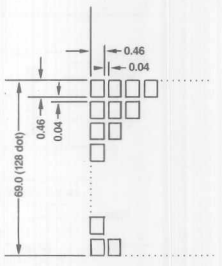
Pin No.	Symbol	Function
6	NC	No Connection
7	V_{DD}	Power supply for logic circuit (+5V)
8	V_{SS}	Ground
9	V_{EE}	LCD drive voltage
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	STANDARD	NO

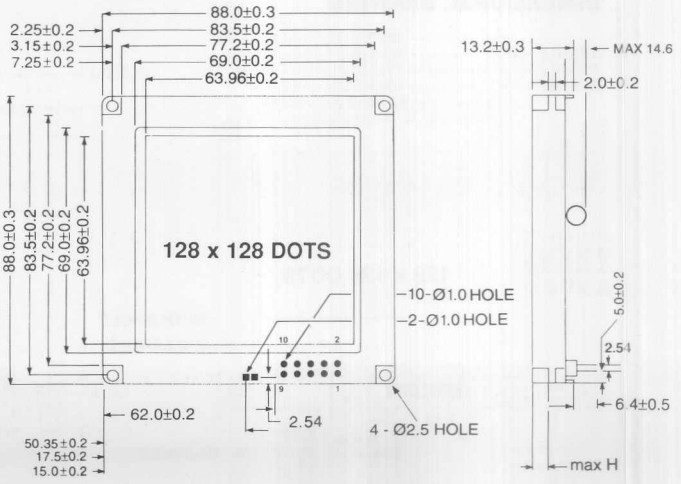
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3160

128 x 128 FORMAT

■ COMPACT SQUARE PACKAGE

■ HD61830 CONTROLLER ON-BOARD ■ SINGLE +5V POWER SUPPLY

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage*	V_{EE}			-17	-20	V
Current Consumption	I_{DD}				30	mA
						mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 0°C		21.1		V
		Temp 25°C		19.4		V
		Temp 50°C		17.3		

*Internally Generated

ABSOLUTE MAXIMUM RATING

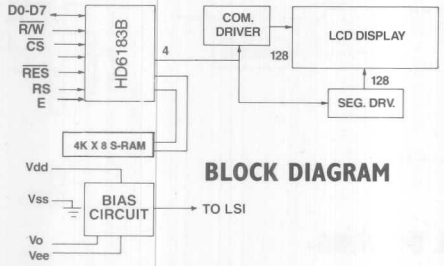
Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	8.0	25	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adjustment
4	RS	Register Select 0 = Instruction Register 1 = Data Register
5	R/$\overline{W}$	Read/Write
6	E	Enable: Active High
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

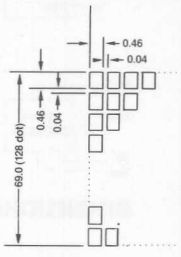
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS}$	Chip Select
16	$\overline{RST}$	Reset
17	V_{EE}	Power Supply for LC driving LCD Drive Voltage Internally Generated
18	NC	No connection
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	STANDARD	NO

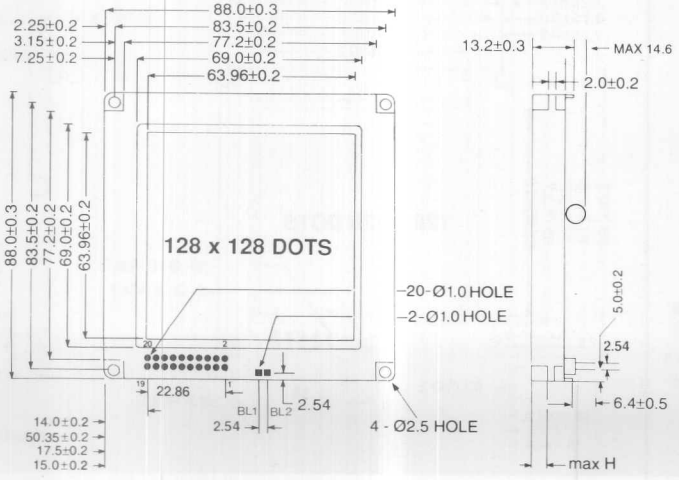


BLOCK DIAGRAM

DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3129/4129

128 x 240 FORMAT

■ HD61830 CONTROLLER ON BOARD

■ EL OR LED BACKLIGHT ■ WIDE TEMP FLUID OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-16.0	-20.0	V
Current Consumption	I_{DD}			30		mA
	I_{EE}			7		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 0°C		21.0		V
		Temp 25°C		18.5		V
		Temp 50°C		16.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

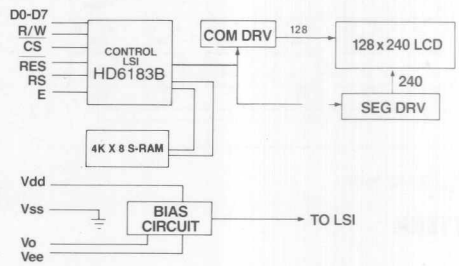
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage (+5V)
3	V_0	LC drive voltage for contrast adj
4	RS	Register Select 0 = Instruction Re 1 = Data Register
5	R/$\overline{W}$	Read/Write: 0 = Write MPU - > LCD Module 1 = Read MPU < - LCD Module
6	E	Enable: Active High (H ->L)
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

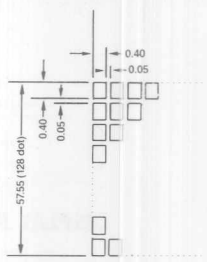
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS}$	Chip Select
16	$\overline{RES}$	Reset (Active Low)
17	V_{EE}	Power Supply for LC driving
18	NC	No connection
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

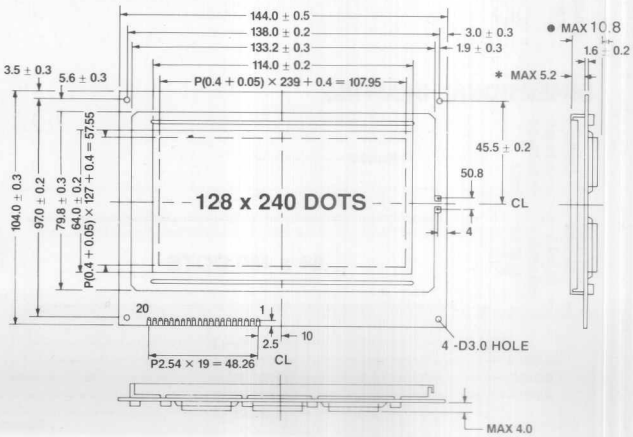
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



• SERIES 4129 MAX 15.6 * SERIES 4129 MAX 10.0

LM3229/4229

128 x 240 FORMAT

■ EL OR LED BACKLIGHT

■ T6963 CONTROLLER ON BOARD ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-16.0	-20.0	V
Current Consumption	I_{DD}			30		mA
	I_{EE}			7		mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 0°C		21.0		V
		Temp 25°C		18.5		V
		Temp 50°C		16.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

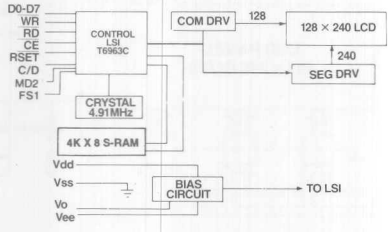
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage (+5V)
3	V_0	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D = "H": Command Write C/D = "L": Data Write RD ="L"..C/D = "H": Status Read C/D "L": Data Read
5	$\overline{RD}$	Data Read
6	$\overline{WR}$	Data Write
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

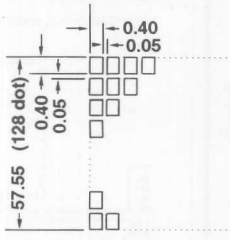
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	V_{EE}	Logic Supply Voltage
18	MD2	Font Size Selection
19	FS1	Font Size Selection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

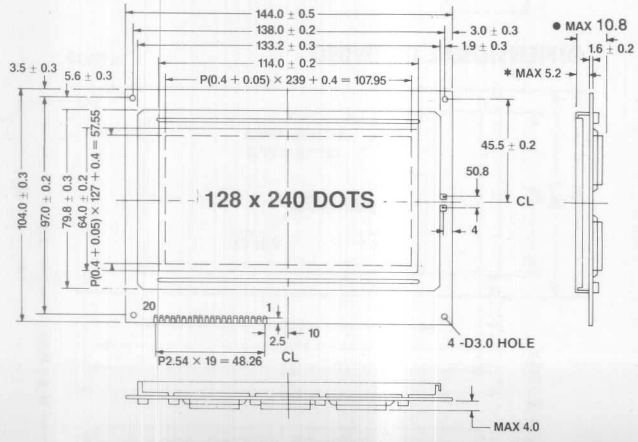
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LED BACKLIT LM4229 SERIES

● = 15.6 mm ✱ = 10.0 mm

LM6129

128 x 240 FORMAT

■ CFL BACKLIGHT

■ HD61830B CONTROLLER ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-16	-20	V
Current Consumption	I_{DD}			30		mA
	I_{EE}			7.0		mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 0°C		21.0		V
		Temp 25°C		18.5		V
		Temp 50°C		16.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

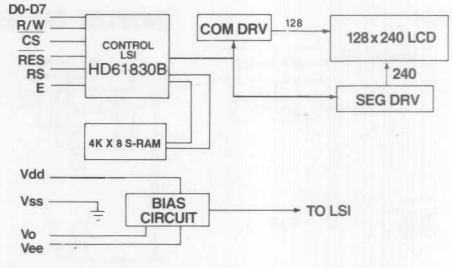
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage
3	V_0	LC drive voltage for contrast adjustment
4	RS	Register Select 0 = Instruction Register 1 = Data Register
5	R/$\overline{W}$	Read/Write
6	E	Enable: Active High
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

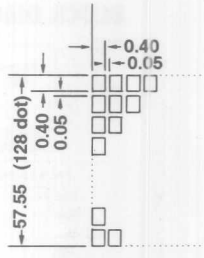
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CS}$	Chip Select
16	$\overline{RST}$	Reset
17	V_{EE}	Power Supply for LC driving
18	NC	No connection
19	NC	No connection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

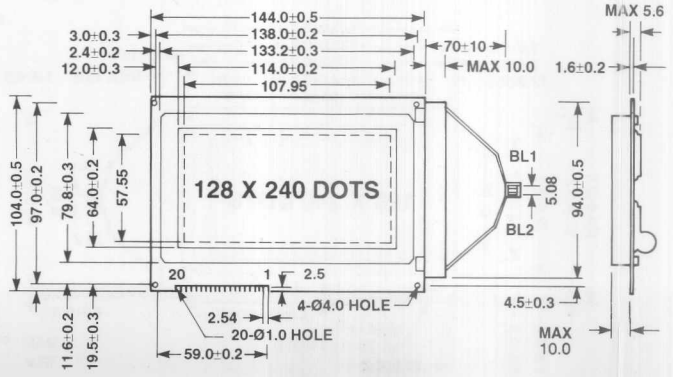
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM6229

128 x 240 FORMAT

■ CFL BACKLIGHT
■ T6963 CONTROLLER ■ WIDE TEMP OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-16	-20	V
Current Consumption	I_{DD}			30		mA
	I_{EE}			7		mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 0°C		21.0		V
		Temp 25°C		18.5		V
		Temp 50°C		16.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$		25.0	V
Temperature ~ Operating	Top	0	50	°C
Temperature ~ Storage	Tstg	-20	70	°C

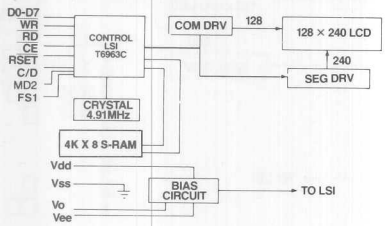
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{DD}	Logic Supply Voltage (+5V)
3	V_0	LC drive voltage for contrast adjustment
4	C/$\overline{D}$	WR = "L"..C/D = "H": Command Write C/D = "L": Data Write RD ="L"..C/D = "H": Status Read C/D "L": Data Read
5	$\overline{RD}$	Data Read
6	$\overline{W}$/R	Data Write
7	DB_0	Bi-directional Data Bus Line 0
8	DB_1	Bi-directional Data Bus Line 1
9	DB_2	Bi-directional Data Bus Line 2

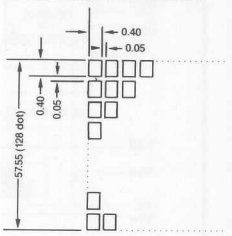
Pin No.	Symbol	Function
10	DB_3	Bi-directional Data Bus Line 3
11	DB_4	Bi-directional Data Bus Line 4
12	DB_5	Bi-directional Data Bus Line 5
13	DB_6	Bi-directional Data Bus Line 6
14	DB_7	Bi-directional Data Bus Line 7
15	$\overline{CE}$	Chip Enable
16	$\overline{RES}$	Reset
17	V_{EE}	Logic Supply Voltage
18	MD2	Font Size Selection
19	FS1	Font Size Selection
20	NC	No connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	YES	YES	YES

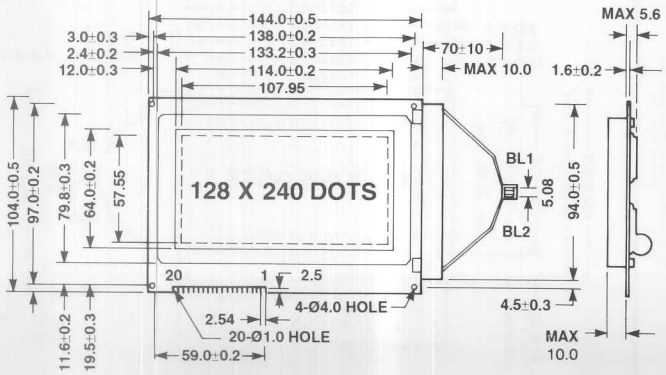
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM3024/6024

128 x 240 FORMAT

■ WIDE TEMP OPERATION ■ EL OR CFL BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.20	V
LCD Drive Voltage	V_{EE}			-24	-26	V
Current Consumption	I_{DD}			10	15	mA
	I_{EE}			26	32	mA
LCD Drive Voltage (duty cycle)	V_{DD}-V_0	Temp 0°C		16.8		V
		Temp 25°C		15.4		V
		Temp 70°C		12.6		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	32	V
Temperature ~ Operating	Top	-10	70	°C
Temperature ~ Storage	Tstg	-20	80	°C

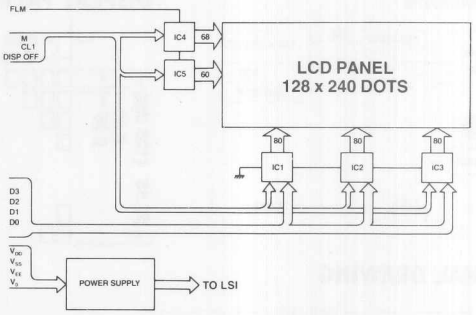
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	The FLM signal indicates the beginning of each display cycle
2	LP	Latches the serial data in the shift registers
3	CP	Clock signal for shifting the serial data
4	(M)	Control signal for AC driving
5	NC	No Connection
6	V_{DD}	+5V (power supply for logic)
7	V_{SS}	GND

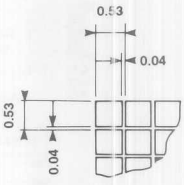
Pin No.	Symbol	Function
8	V_{EE}	-24V (power supply for LCD)
9	D0	Screen data H = ON L = OFF
10	D1	Screen data H = ON L = OFF
11	D2	Screen data H = ON L = OFF
12	D3	Screen data H = ON L = OFF

Display Options Available	Wide Temp Operation (-10°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	STANDARD	NO	NO

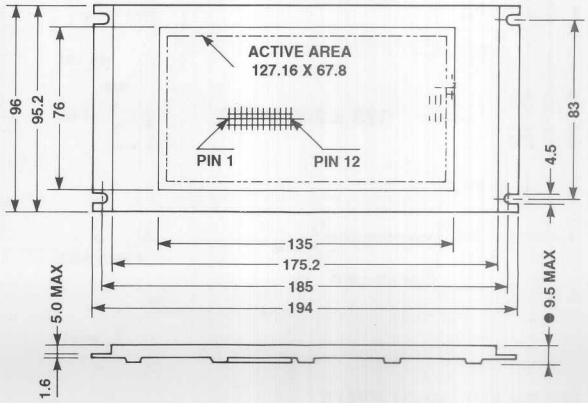
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



● LM6024 SERIES = 16 mm MAX

LMG6627

128 x 240 FORMAT

■ MINI 128 x 240 MODULE DESIGN
■ HIGH BRIGHTNESS CFL BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-22.0	-23.0	-24.0	V
Current Consumption	I_{DD}	fCL2 = 0.55MHz		4.0	8.0	mA
	I_{EE}	D_0 -D_3 = GND		3.5	7.5	mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 5°C		18.9		V
		Temp 25°C		17.5		V
		Temp 40°C		16.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} ~ V_{SS}	0	6.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	0	30.0	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

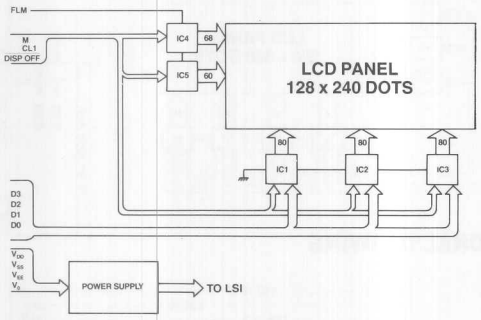
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	(M)	Control signal for AC drive
3	CL1	Clock signal for latching the serial data
4	CL2	Clock signal for shifting the serial data
5	$\overline{DISP\ OFF}$	H = Display on L = Display off
6	D_0	Data 0 H = on L = off

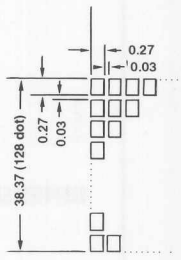
Pin No.	Symbol	Function
7	D_1	Data 1H = on L = off
8	D_2	Data 2 H = on L = off
9	D_3	Data 3 H = on L = off
10	V_{DD}	Logic supply voltage +5V
11	V_{SS}	Ground
12	V_{EE}	Power supply for LC driving (-23)
13	V_0	LC Drive Voltage for Contrast Adj
14	FG	GND (frame)

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

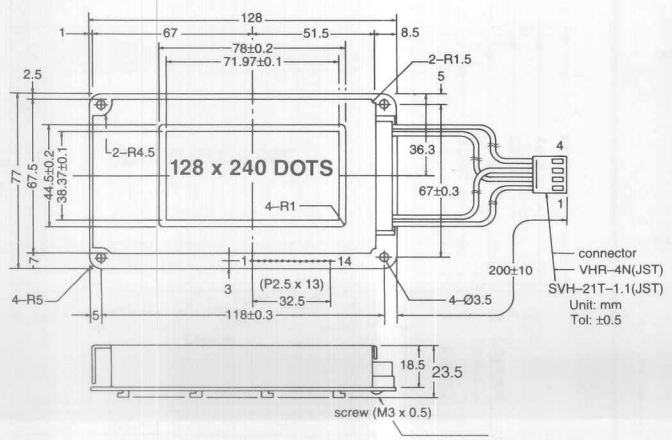
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM656

128 x 256 FORMAT

■ CFL BACKLIGHT ■ 1/64 DUTY

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}		-11.0	-12.0	-13.0	V
Current Consumption	I_{DD}			5.2		mA
	I_{EE}			2.3		mA
LCD Drive Voltage (1/64 duty cycle)	V_{DD}-V_0	Temp 5°C		16.4		V
		Temp 25°C		15.7		V
		Temp 40°C		15.0		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} ~ V_{SS}	-0.3	7.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	-0.3	18.0	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-10	50	°C

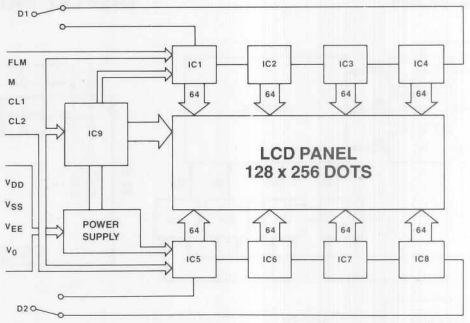
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D_1	Display data H..Dot On, L..Dot Off
2	FLM	First line marker indicates the beginning of each display cycle
3	NC	No Connection
4	CL1	The CL1 latches the serial data in the shift registers
5	CL2	Clock signal for shifting the serial data

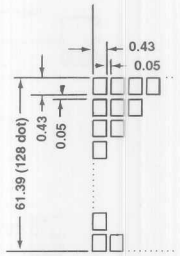
Pin No.	Symbol	Function
6	D_2	Display data H..Dot On, L..Dot Off
7	V_{DD}	+5V Power supply for logic circuit
8	V_{SS}	Ground
9	V_{EE}	Power supply for LC drivers (-12V)
10	V_0	Operating voltage for LC drivers

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

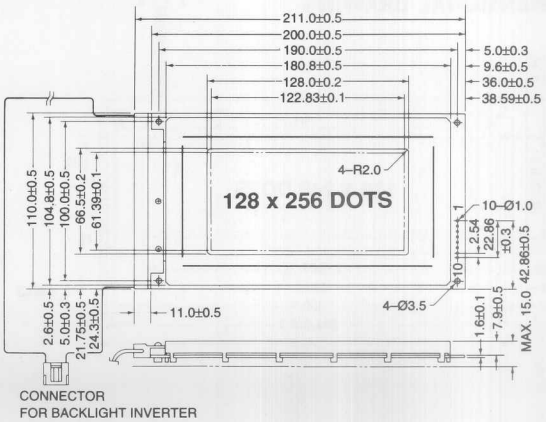
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG6685

128 x 480 FORMAT

■ HIGH BRIGHTNESS CFL BACKLIGHT ■ LARGE SCREEN SIZE

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}			5.0		V
LCD Drive Voltage	V_{EE}			-23.0		V
Current Consumption	I_{DD}			3.5	8.0	mA
	I_{EE}			3.0	7.5	mA
LCD Drive Voltage (1/128 duty cycle)	V_{DD}-V_0	Temp 5°C		19.8		V
		Temp 25°C		18.1		V
		Temp 40°C		16.8		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	30	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

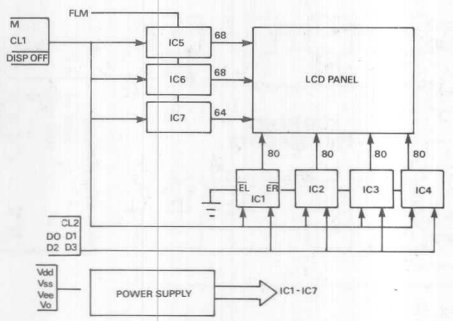
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FCND	Frame Ground 0V
2	NC	
3	FLM	The FLM signal indicates the begining of each display cycle
4	CL1	The CL1 latches the serial data
5	CL2	Clock signal for shifting the serial data
6	Vss	GND

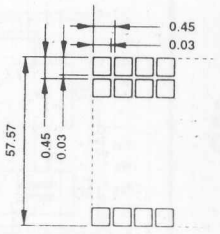
Pin No.	Symbol	Function
7	D0	Screen Data H = On L = Off
8	D1	Screen Data H = On L = Off
9	D2	Screen Data H = On L = Off
10	D3	Screen Data H = On L = Off
11	Vss	GND
12	V_{DD}	+5V (power supply for logic)
13	V_0	Operating voltage for LC driving
14	V_{EE}	-23V (power supply for LC driving
15	Vss	GND

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

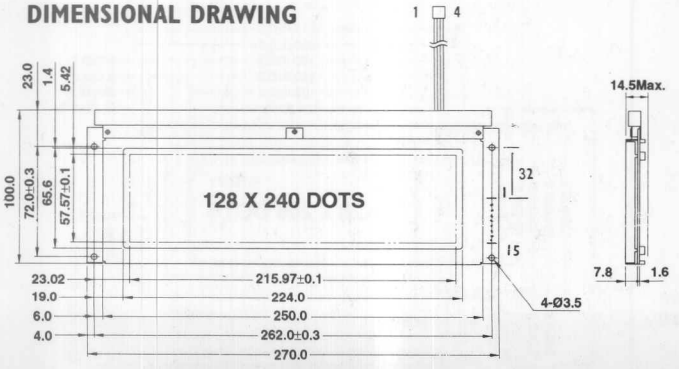
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG50

200 x 320 FORMAT

■ REFLECTIVE OR TRANSFLECTIVE ■ EL BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	6.0	V
LCD Drive Voltage	V_{EE}		-22.0	-23.0	-24.0	V
Current Consumption	I_{DD}			4.4		mA
	I_{EE}			3.7		mA
LCD Drive Voltage (1/200 duty cycle)	V_0-V_{EE}	Temp 5°C		27.0		V
		Temp 25°C		25.5		V
		Temp 40°C		24.5		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	30	V
Temperature ~ Operating	Top	0	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

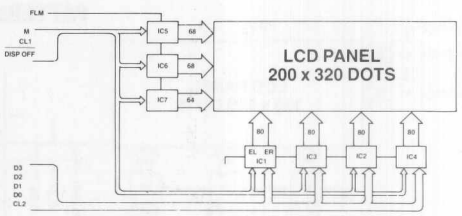
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	$\overline{DISP\ OFF}$	Display on/off signal: H...Display on, L...Display off
6	D_0	Data 0 H...Dot on, L...Dot off

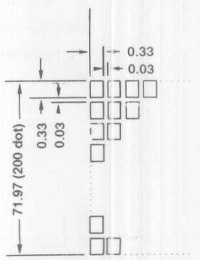
Pin No.	Symbol	Function
7	D_1	Data 1 H...Dot on, L...Dot off
8	D_2	Data 2 H...Dot on, L...Dot off
9	D_3	Data 3 H...Dot on, L...Dot off
10	V_{DD}	Power line for logic circuit
11	V_{SS}	Ground
12	V_{EE}	Power line for LC drive (-23V)
13	V_0	Operating voltage for LC driver
14	NC	No Connection

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

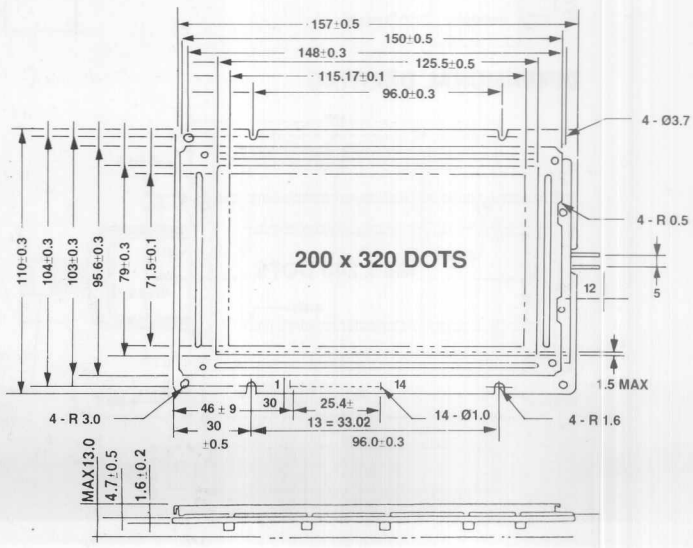
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LM650

200 x 320 FORMAT

■ CCFL BACKLIGHT ■ TRANSMISSIVE OR TRANSFLECTIVE OPTION

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	6.0	V
LCD Drive Voltage	V_{EE}		-22.0	-23.0	-24.0	V
Current Consumption	I_{DD}			4.4		mA
	I_{EE}			3.7		mA
LCD Drive Voltage (1/200 duty cycle)	V_O - V_{EE}	Temp 5°C		27.0		V
		Temp 25°C		25.5		V
		Temp 40°C		24.5		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD}	0	6.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	0	30.0	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

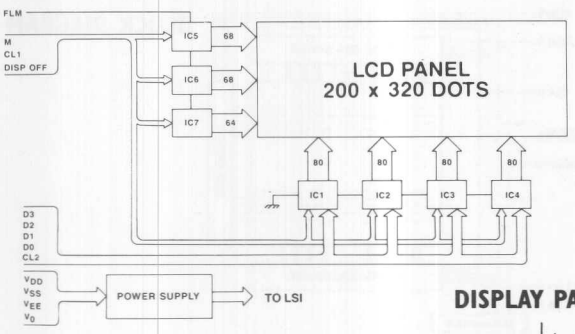
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	First line marker indicates the beginning of each display cycle
2	M	Control signal for AC drive
3	CL1	The CL1 latches the serial data in the shift registers
4	CL2	Clock signal for shifting the serial data
5	$\overline{DISP\ OFF}$	H...Display on, L...Display off
6	D_0	Data 0 H...Dot on, L...Dot off

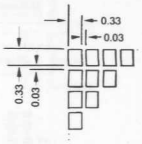
Pin No.	Symbol	Function
7	D_1	Data 1 H...Dot on, L...Dot off
8	D_2	Data 2 H...Dot on, L...Dot off
9	D_3	Data 3 H...Dot on, L...Dot off
10	V_{DD}	+5V
11	V_{SS}	Ground
12	V_{EE}	Power supply for LC drivers (-23)
13	V_O	Operating voltage for LC drivers
14	NC	

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

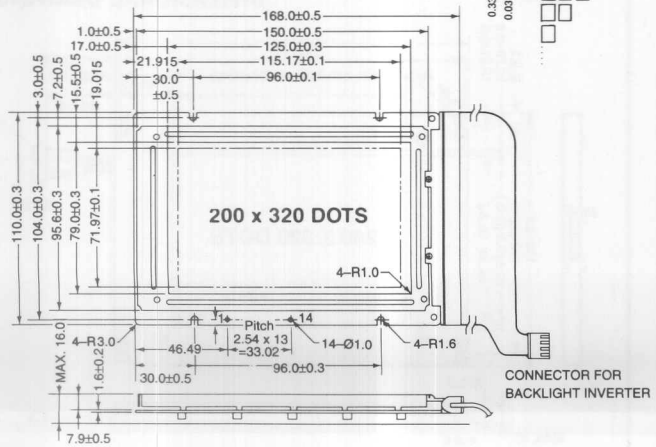
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG6683

200 x 320 FORMAT

■ HIGH CONTRAST DISPLAY ■ CFL BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}			5.0		V
LCD Drive Voltage	V_{EE}			-23.0		V
Current Consumption	I_{DD}			3.5		mA
	I_{EE}			3.0		mA
LCD Drive Voltage (1/200 duty cycle)	V_{DD}- V_O	Temp 5°C		22.8		V
		Temp 25°C		21.4		V
		Temp40°C		20.4		V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	V_{DD} ~ V_{SS}	0	6.0	V
LCD Drive Voltage	V_{DD} ~ V_{EE}	0	30.0	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

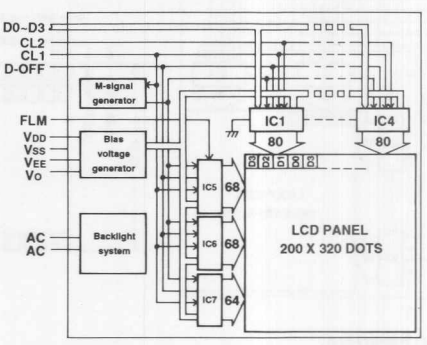
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	FLM	The FLM signal indicates the beginning of each display cycle
2	NC	
3	$\overline{D\ OFF}$	Display enable signal H = ON, L = OFF
4	CL1	The CL1 latches the serial data
5	V_{SS}	GND
6	CL2	Clock signal for shifting the serial data
7	V_{SS}	GND
8	D0	Data 0 H = ON (White) L = OFF (Blue)

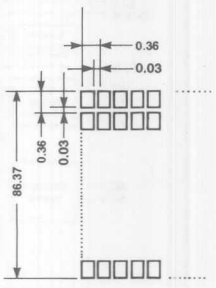
Pin No.	Symbol	Function
9	D_1	Data 1 H = ON (White) L = OFF (Blue)
10	D_2	Data 2 H = ON (White) L = OFF (Blue)
11	D_3	Data 3 H = ON (White) L = OFF (Blue)
12	V_{DD}	+5V (Power supply for Logic)
13	V_{SS}	GND
14	V_{EE}	-23V (Power supply for Logic)
15	V_O	Operating voltage for LC driving

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

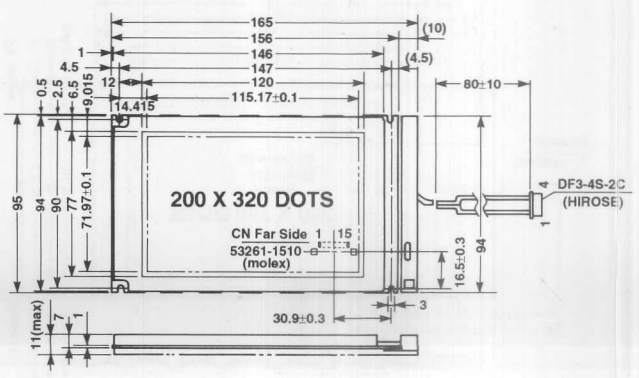
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG620

240 x 320 FORMAT

■ 1/4 VGA SCREEN
■ HIGH CONTRAST ■ CFL BACKLIGHT

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5	5.25	V
LCD Drive Voltage	V_{EE}			-23.0		V
Current Consumption	I_{DD}			5.0		mA
	I_{EE}			4.0		mA
LCD Drive Voltage (1/240 duty cycle)	V_{DD}-V_0	Temp 5°C			28.0	V
		Temp 25°C		24.0		V
		Temp 40°C	20.0			V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	7.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	30.0	V
Temperature ~ Operating	Top	5	40	°C
Temperature ~ Storage	Tstg	-20	60	°C

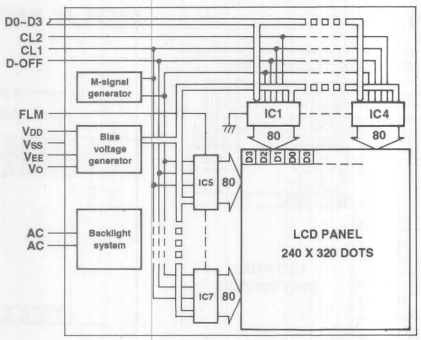
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	V_0	Operating voltage for LC driving
2	V_{EE}	-23V (Power supply for LC driving.)
3	D0	Data 0 H=ON L=OFF
4	D1	Data 1 H=ON L=OFF
5	D2	Data 2 H=ON (L=OFF
6	D3	Data 3 H=ON L=OFF

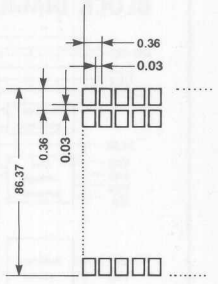
Pin No.	Symbol	Function
7	D OFF	Display enable signal H=ON, L=OFF
8	V_{SS}	GND
9	V_{DD}	+5V (Power supply for Logic.)
10	CL2	Clock signal for shifting the serial data
11	CL1	The CL1 latches the serial data
12	FLM	The FLM signal indicates the beginning of each display cycle.

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

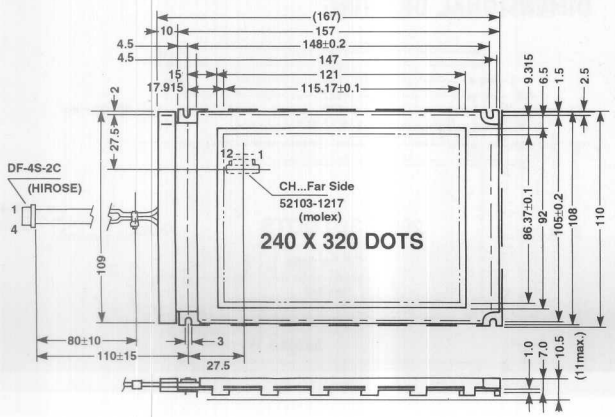
BLOCK DIAGRAM



DISPLAY PATTERN



DIMENSIONAL DRAWING



LMG8382

240 x 320 x RGB FORMAT

■ COLOUR FSTN DISPLAY
■ 1/4 VGA FORMAT ■ HIGH CONTRAST

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}		4.75	5.0	5.25	V
LCD Drive Voltage	V_{EE}			-23.0		V
Current Consumption	I_{DD}			5.5		mA
	I_{EE}			5.0		mA
LCD Drive Voltage (1/240 duty cycle)	V_{DD}-V_0	Temp 10°C			28.0	V
		Temp 25°C		26.5		V
		Temp 40°C	20.0			V

ABSOLUTE MAXIMUM RATING

Item	Symbol	Min.	Max.	Unit
Logic Voltage	$V_{DD} \sim V_{SS}$	0	6.0	V
LCD Drive Voltage	$V_{DD} \sim V_{EE}$	0	30	V
Temperature ~ Operating	Top	10	40	°C
Temperature ~ Storage	Tstg	-10	50	°C

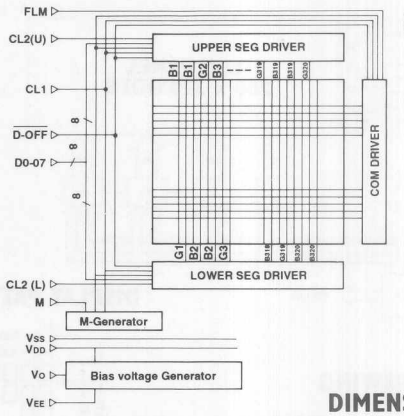
CONNECTOR ASSIGNMENT

Pin No.	Symbol	Function
1	D7	Display data
2	D6	Display data
3	D5	Display data
4	D4	Display data
5	D3	Display data
6	D2	Display data
7	D1	Display data
8	D0	Display data
9	V0	Operating voltage for LC driving
10	V_{EE}	Power supply voltage for LCD (-23V)
11	V_{SS}	GND

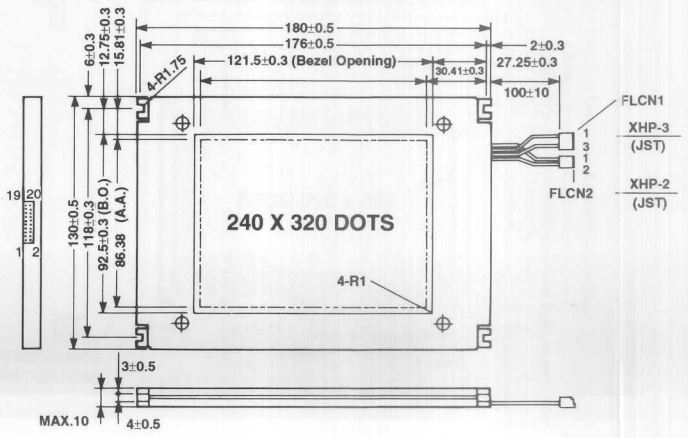
Pin No.	Symbol	Function
12	V_{DD}	+5V
13	CL2(L)	Clock signal for shifting the serial data (Lower driver)
14	V_{SS}	GND
15	CL2(U)	Clock signal for shifting the serial data (Upper driver)
16	V_{SS}	GND
17	CL1	The CL1 latches the serial data in the shift registers
18	$\overline{D\text{-off}}$	H: display ON, L: display OFF
19	(M)	NC
20	FLM	The FLM signal indicates the beginning of each display signal

Display Options Available	Wide Temp Operation (-20°C to +70°C)	On Board Negative Voltage Generator	On-board Temperature Compensation
	NO	NO	NO

BLOCK DIAGRAM



DIMENSIONAL DRAWING



CONTROLLER OPTIONS

Densitron provides a complete range of controller cards designed specifically to work with the Densitron range of small graphic LCD panels which do not have an on-board controller.

Type A, LM1001GC:
Hitachi HD61830 chip set and 2K bytes of RAM for display types LM54, LM83, LM3083 and LM4083.

Type B, LM1002GC-B:
Hitachi HD61830B chip set and 4K bytes of RAM for display type LM95.

Type C, LM1002GC:
Hitachi HD61830 chip sets and 4K bytes of RAM for display types LM656, LM3060, LM3024, LM6024 and LMG6627.

Type D, LM1006GC:
Two Hitachi HD61830 chip sets and 8K bytes of RAM for a 128 x 480 dot format panel, type LMG6685.

Type E, DBC-02:
This unit is designed to be a general purpose graphic LCD panel controller for dot formats of 128 x 240 and 200 x 320. The host interface provides an easy connection to any 8-bit microprocessor system. The unit is 4" x 3" in size and has on-board -Vee voltage generator.

Type F, SGI-01:
This versatile controller card will drive all small graphic displays up to 128 x 256 resolution from a serial (RS232) or I²C interface. The card allows multiple displays to be chained together and whilst remaining individually addressable.

Densitron offers some LCD graphic models with on-board controller and some features of these are shown below. These models include on-board RAM for display memory and can interface to any 8-bit microprocessor system.

MODELS WITH HITACHI HD61830 CONTROLLER CHIP

- Easy interface to most 8-bit microprocessors
- 160 x (5 x 7 format) character generator
- 32 x (5 x 11 format) character generator
- Supports bit mapped graphics
- Software selectable character pitch

MODELS WITH ON-BOARD HITACHI HD61202 CONTROLLER CHIP

- Simple and inexpensive controller/driver solution which interfaces to an 8-bit microprocessor
- Supports bit mapped graphics but does not have character generator

MODELS WITH ON-BOARD TOSHIBA T6963C CONTROLLER CHIP

- Easy interface to most 8-bit microprocessors
- 128 x (5 x 7 format) character generator
- 128 x custom (user defined) character generator
- Text and graphics modes used simultaneously
- Supports bit mapped graphics
- Software selectable inverse video mode

MODELS WITH ON-BOARD TOSHIBA T9841B CONTROLLER CHIP

- Simple and inexpensive controller/driver solution which interfaces to an 8-bit microprocessor
- Supports bit mapped graphics but does not have character generator
- Supports digital contrast adjustment
- Generates -5V for LC Drive Voltage

LM1001GC/GCB/ LM1002GC SERIES

Graphic Controller Cards

DESCRIPTION

The LM1001GC and LM1002GC cards are dedicated controllers for Densitron's small graphic LCD's. Both cards contain a microcontroller, display RAM and clock circuitry factory set for the display it is to drive. The difference in the two versions is the size of the RAM. Select the proper card based upon display size. The controller card provides all critical timing and data signals to the display. The system CPU need only communicate to the card during initialization and when changing information. The cards are pin-for-pin compatible with Densitron's displays. An 8-bit data bus interface with 4 control lines facilitates a straightforward connection to most common microprocessors. It can be initialised to accept data as ASCII characters or in dot-address graphic patterns. A 5x7 dot character generator (with 1 dot intercharacter spacing) is contained within the microcontroller. An optional ROM socket is provided on the card for a custom character generator.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	4.75	5.0	5.25	V
Current Consumption	I_{DD}	-	12.0	-	mA
Max. Logic Voltage	V_{DD}	0	-	7.0	V
Temperature - Operating	T_{op}	-10	-	60	°C
Temperature - Storage	T_{stg}	-20	-	70	°C

From Host

Pin No.	Symbol	Function
1	V_{SS}	Ground
2	V_{CC}	+5VDC
3	V_O	Operating voltage for LC drivers*
4	RS	Register Select
5	R/W	Read/Write
6	E	Enable
7	DB0	Data Line 0
8	DB1	Data Line 1
9	DB2	Data Line 2
10	DB3	Data Line 3
11	DB4	Data Line 4
12	DB5	Data Line 5
13	DB6	Data Line 6
14	DB7	Data Line 7
15	$\overline{CS}$	Chip Select
16	RES	Reset
17	V_{EE}	Power supply for LC drivers*
18	NC	No Connection
19	NC	No Connection
20	NC	No Connection

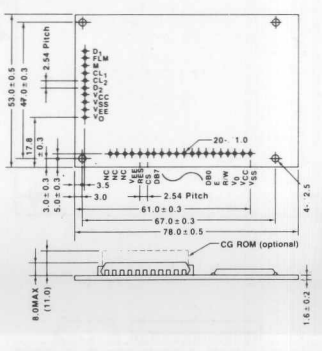
To Display

*Not used by controller; passed directly to display

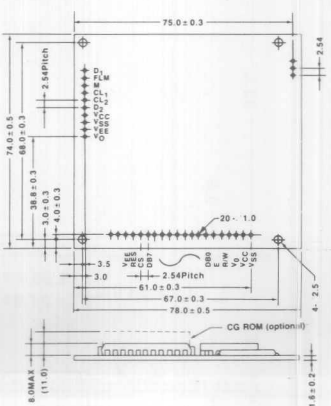
Pin No.	Symbol	Function
1	D1	Display Data (1)
2	FLM	First Line Marker
3	M	Control Signal
4	CL1	Clock #1
5	CL2	Clock #2
6	D2	Display Data (2)
7	V_{CC}	+5VDC
8	V_{SS}	Ground
9	V_{EE}	Power supply for drivers
10	V_O	Operating voltage for LC drivers

DIMENSIONAL DRAWING

LM1001GC



LM1002GC



LM1006GC SERIES

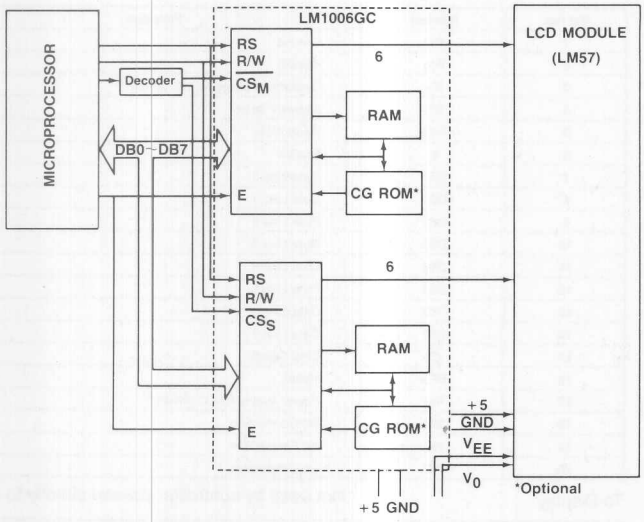
Graphic Controller Card

The LM1006GC is designed for the Model LM57 display. Its attributes are identical to the LM1001GC and LM1002GC described on the previous pages, though to accomodate the 128 x 480 configuration, two controllers and associated circuitry are used so that the hardware is reduced and I/O signals are shared.

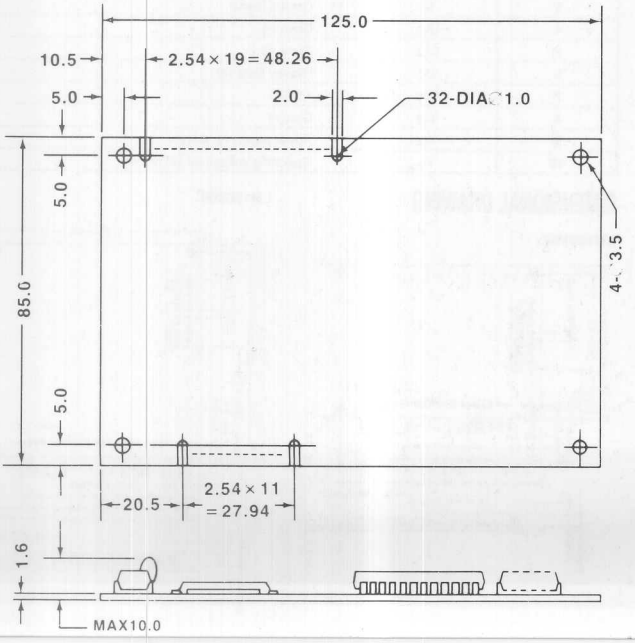
ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	4.5	5.0	5.5	V
Current Consumption	I_{DD}	—	16.0	—	mA
Max. Logic Voltage	V_{DD}	0	—	7.0	V
Temperature-Operating	Top	0	—	50	°C
Temperature-Storage	Tstg	−20	—	60	°C

TYPICAL SYSTEM BLOCK DIAGRAM



DIMENSIONAL DRAWING



SGI-01 Serial Interface

The new SGI-01 serial interface card simplifies communication with Densitron's small graphic LCD modules. This card features a powerful command set for drawing lines, circles, boxes, arcs, sectors and text with minimal code. Complex screen designs can be created easily. This greatly reduces the amount of time required for software design, reduces your costs and time to market.

Four basic font styles are built in; sizes range from 8 to 20 pixels high. Characters may be displayed as bold, italicised, underlined, mirrored, rotated or any combination thereof. Text and graphics may be mixed and displayed at the same time. Graphics can be created by using the drawing command set or by built in bit-mapping data directly to the display.

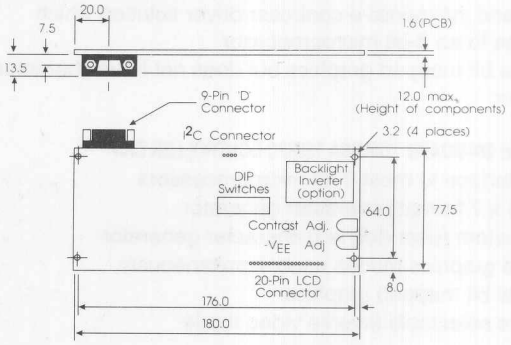
Either of the two user selectable serial interfaces can be used: an RS232 bi-directional serial port with user selectable baud rates from 150-19,200 Baud, allows remote operation up to 65 feet (or further depending on the baud rate selected); an I2C synchronous serial bus can have up to eight SGI-01 cards and LCD modules each independently controlled on the same serial line.

The SGI-01 card fully supports Densitron's graphic LCD modules with built-in T6963C, HD61830 and HD61202 controllers. It provides all the necessary LCD drive voltages, signals and correct timing to interface to most of Densitron's small graphic LCD modules up to 1/128 duty cycle (multiplex rate). The LCD drive voltage (-VEE) is adjustable from -5 to -20V. The contrast voltage (-Vo) may be adjusted by the on-board contrast potentiometer or by external control.

LCD module backlights may be controlled via software. An LED current limit resistor (9.4Ω) or a DC-AC inverter is installed, depending on LCD module backlight type.

The SGI-01 has been designed as an intelligent serial interface, that saves you time and money and enables complex screens to be created and displayed with relative simplicity. Contact Densitron for a demonstration and product literature showing our extensive range of LCD modules and interface cards.

DIMENSIONAL DRAWING



	Min	Typ	Max
Input Voltage (VDC)	4.75	5.0	5.25
V_{EE} Output (VDC)	-5.0		-20.0
Operating Temp (°C)	0		40
Storage Temp (°C)	-10		60

(Input Voltage is feed through to the display. V_{EE} is generated on the SGI-01and adjusted to display specifications.)

DBC-02 SERIES

Graphic Controller Card

DESCRIPTION

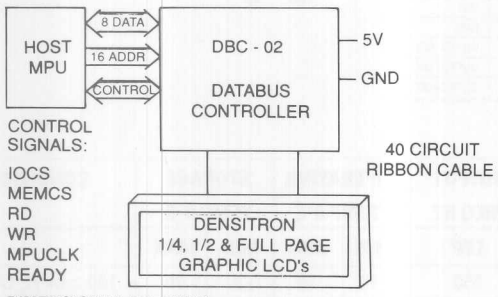
The DCB-02 data bus controller is designed around a powerful VLSI LCD controller chip. The card has up to 64Kbytes of video RAM which will operate flat panel displays with up to 524,288 dots. The card provides all necessary display scan and refresh signals for LCD panels. Model DBC-02 can be memory mapped into most 8-bit data bus microprocessor systems. LCD contrast may be adjusted either by the on-board or an external potentiometer. The 64Kbytes of video RAM may be directly accessed by the host MPU, by mapping the video RAM into the host MPU's memory map. The mode of operation of the DBC-02 is set by 14 I/0 control registers.

The DBC-02 will interface to a variety of 8-bit microprocessors with a minimum amount of interface circuitry. Microprocessors with clocks between 1.0 and 12.5 MHz are suitable, if they have a READY (WAIT) input pin.

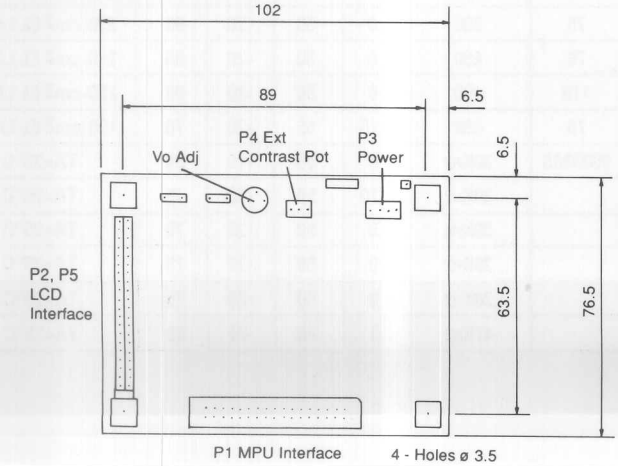
ELECTRICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Logic Voltage	V_{DD}	4.5	5.0	5.5	V
Current Consumption	I_{DD}	---	50.0	---	mA
Max. Logic Voltage	V_{DD}	0	---	7.0	V
Temperature-Operating	Top	0	---	50	°C
Temperature-Storage	Tstg	-20	---	70	°C

BLOCK DIAGRAM



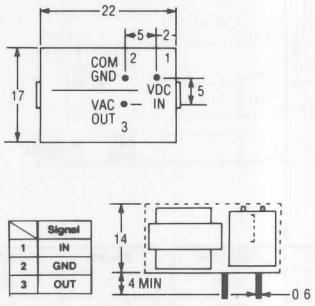
DIMENSIONAL DRAWING



BACKLIGHT INVERTERS

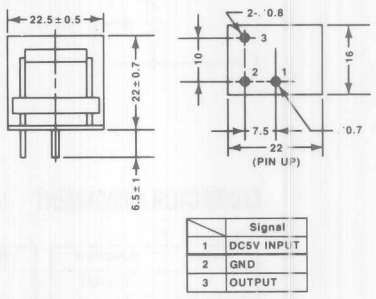
DAS5V4

DIMENSIONAL DRAWING



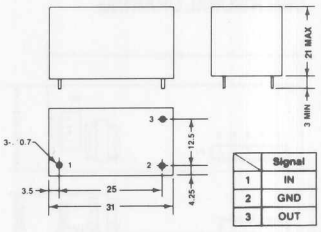
DAS5V7

DIMENSIONAL DRAWING



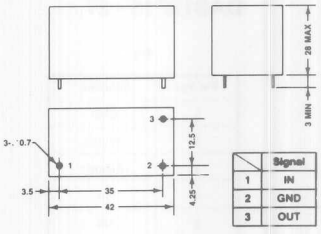
DAS5V10

DIMENSIONAL DRAWING



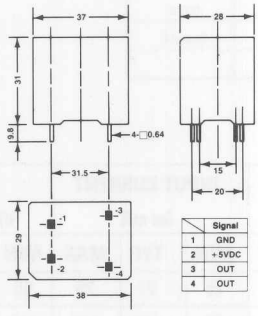
DAS5V12

DIMENSIONAL DRAWING



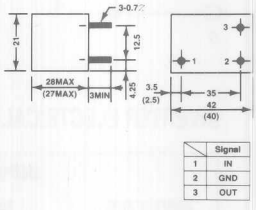
DAS5V13

DIMENSIONAL DRAWING



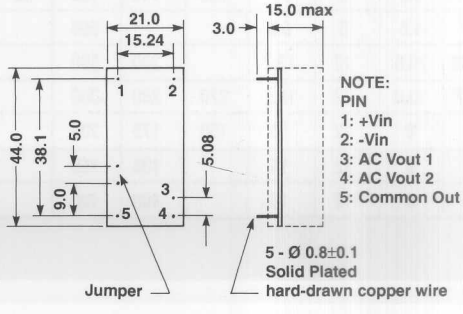
DAS5V14

DIMENSIONAL DRAWING

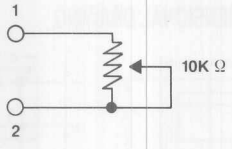


INV - 12

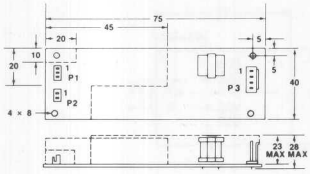
DIMENSIONAL DRAWING



DAS12F06 - 39



DIMENSIONAL DRAWING



CONNECTOR ASSIGNMENT

P1

PIN NO.	FUNCTION
1	+ 12VDC
2	GND
3	Enable

P2

PIN NO.	FUNCTION
1	V_R IN
2	V_R IN

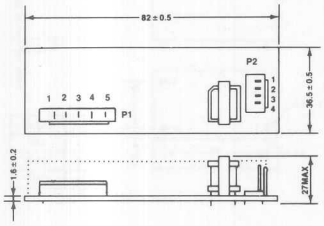
P3

PIN NO.	FUNCTION
1	Output
2	N/C
3	N/C
4	Output

Enable Function
0 (GND) = Lamp ON
1 (V_{IN} or OPEN) = Lamp OFF

DAS12F15 - 27

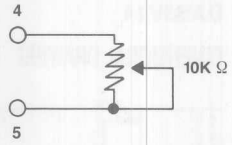
DIMENSIONAL DRAWING



P1

Pin No.	Function
1	GND
2	H2VDC
3	Enable
4	V_R
5	V_R

Control for variable brightness

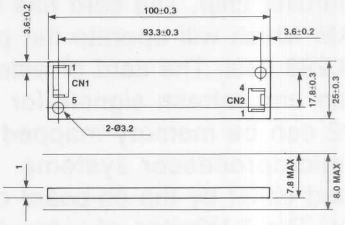


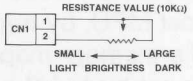
P2

Pin No.	Function
1	Output 1
2	N/C 1
3	N/C 2
4	Output 2

DAS12F39-1

DIMENSIONAL DRAWING

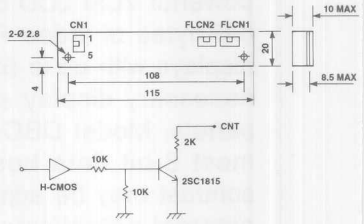




CN No	Pin No	Signal
CN1	1	VR (H) (10KΩ)
	2	VR (H) (10KΩ)
	3	CNT
	4	GND
	5	V_{IN} (12V DC)
CN2	1	OUTPUT (AC)
	2	-
	3	-
	4	OUTPUT (AC)

DAS12F57

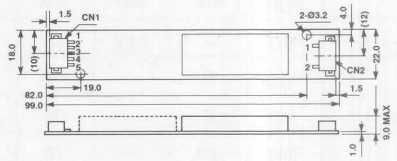
DIMENSIONAL DRAWING



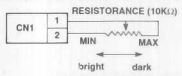
Pin No	Signal
1	GND (0V)
2	VFL (DC+12V)
3	CNT
4	GR A
5	VR A

DAS12F56

DIMENSIONAL DRAWING



CN No	Pin No	Signal
CN1	1	VR (H) (5KΩ)
	2	VR (H) (5KΩ)
	3	CNT
	4	GND
	5	V_{IN} (12V DC)
CN2	1	OUTPUT (AC)
	2	OUTPUT (AC)



INVERTER ELECTRICAL CHART

INVERTER	INPUT VOLTAGE V_{IN} VOLTS			INPUT CURRENT I_{IN} mA			OUTPUT VOLTAGE (VOLTS)			OUTPUT FREQ HZ	OPERATING TEMP 0°C		STORAGE TEMP 0°C		CONDITION
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	TYP	MIN	MAX	MIN	MAX	
DAS5V4	4.5	5	5.5	25	27	29	65	70	75	550	-10	55	-20	70	100-cm2 EL LAMP
DAS5V7A	2.5		6	96	120	144	112	125	138	430	-10	60	-20	70	50-cm2 EL LAMP
DAS5V10	4.5	5	5.5	80	90	110	65	70	75	500	0	50	-20	65	250-cm2 EL LAMP
DAS5V12	4.5	5	5.5	170	200	130	60	65	75	450	0	50	-20	65	250-cm2 EL LAMP
DAS5V13	4.5	5	5.5	270	300	330	102	110	118	400	0	50	-20	65	250-cm2 EL LAMP
DAS5V14	4.5	5	5.5	120	140	160	65	70	75	492	-10	55	-20	70	100-cm2 EL LAMP
INV 12	4.5	5	5.5			500			900RMS	30KHZ	0	50	-10	60	TA=25°C
DAS12F06-39	10.8	12	13.2		260	500		300P-P		30KHZ	-10	55	-20	75	TA=25°C
DAS12F15-27	10.8	12	13.2	220	260	300		2600P-P		30KHZ	0	50	-20	75	TA=25°C
DAS12F39-1	8	12	16	150	175	200		1000P-P		28KHZ	0	50	-20	75	TA=25°C
DAS12F56	8	12	16		135	160		880P-P		30KHZ	0	50	-20	75	TA=25°C
DAS12F57	8	12	16		400	460		950RMS		41KHZ	0	45	-20	60	TA=25°C

DESCRIPTION OF POLARISER TYPE

DESIGNATION	TYPE	DESCRIPTION	AMBIENT LIGHT CONDITIONS			
			DIRECT SUNLIGHT	OFFICE LIGHT	SUBDUED LIGHT	VERY LOW LIGHT
A	REFLECTIVE POSITIVE (NO LAMP)	DARK CHARACTERS ON A VERY LIGHT GREY OR YELLOW BACKGROUND	EXCELLENT	VERY GOOD	POOR	UNUSABLE
B	TRANSFLECTIVE POSITIVE LAMP INSTALLED	DARK CHARACTERS ON A YELLOW BACKGROUND	EXCELLENT (LAMP OFF)	VERY GOOD (LAMP OFF)	VERY GOOD (LAMP ON)	VERY GOOD (LAMP ON)
E	TRANSMISSIVE NEGATIVE LAMP INSTALLED	LIGHTED DOTS OR CHARACTERS ON A DARK BACKGROUND *	FAIR-GOOD (LAMP ON)	GOOD (LAMP ON)	VERY GOOD (LAMP ON)	EXCELLENT (LAMP ON)

*Data can be inverted, improving readability in high ambient light.

ORDERING INFORMATION

Densitron features a "build-a-part-number" system to identify its liquid crystal display modules. Obtain the Model No. based upon the desired format and size. Polariser type determines overall look and viewability in various ambient lighting conditions. An explanation of the part number breakdown is given below.

LXX #### X #G## X X X

SERIES
LM and LMG prefix used for Densitron small graphic modules

MODEL NUMBER
If 1st digit is:
2 or 3 indicates model without backlight or with EL backlight
4 indicates model with LED backlight
6 indicates model with CCFL backlight

CONTROLLER OPTIONS (For LM3/4 series only)
If second digit is:
'0' indicates no controller on-board
'1' indicates HD61830 controller on-board
'2' indicates T6963C controller on-board
'3' indicates HD61202 controller on-board
'4' indicates T9841B controller on-board

POLARISER TYPE
A - Reflective: light background
B - Transflective: light background with backlight
E - Transmissive: dark background with backlight

TEMPERATURE RANGE/ POWER SUPPLY
K or D = Standard temp range/ negative supply voltage required
S = Standard temp range/ on-board negative voltage generator
H = Wide temp range/ negative supply voltage required
W = Wide temp range/ on-board negative voltage generator

FLUID TECHNOLOGY/ COMPENSATION CIRCUIT
F = FSTN
S = STN
N = NTN
C = NTN with on-board temperature compensation circuit

STN, NTN BACKGROUND COLOUR
Y = Yellow background (for A,B polarisers)
G = Grey background (for A,B polarisers)
B = Blue background (for E polarisers)

No Mark - Standard TN
"H" - Extended Temp. (TN and NTN)

FLUID TECHNOLOGY ABBREVIATIONS